DEVELOPMENT OF PADDED BANDANA FOR TAKRAW PLAYERS

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ABSTRACT

This study focuses on the analysis of a headband which is called the bandana. Takraw player often used a bandana on the head just for covering their hair and to sweep sweat. Unfortunately, the bandana is much more unprotected compared to headband because it does not have a material that can absorb an impact from the ball thus can cause a severe injury after several times of heading. It is shown that the understanding of the head impact with this bandana wearing by players in a game is imminent to the biomechanics knowledge. The objective of this study is to identify the most suitable material of bandana and fabricate a bandana based on the result of the experiment that has been conducted. This study involved with 2 types of experiment, which the first experiment conducted on the force plate in order to find the most suitable material for bandana among the 3 types of test material. For the second experiment conducted on the skull prototype in order to compare the parameters between best material results from the previous experiment and a condition without using any test material. The expected result produces from the experiment is the value of material should be relatively closed to or higher or lower than the benchmark value according to each parameter. A material that satisfies each parameter of the experiment was proven as the best material for padded bandana for Takraw players.

ABSTRAK

Kajian ini memberi tumpuan kepada analisis headband yang dipanggil bandana. Pemain Takraw sering menggunakan bandana di kepala hanya untuk menutup rambut mereka dan untuk menyapu peluh. Malangnya, bandana adalah lebih kurang melindungi berbanding dengan headband kerana ia tidak mempunyai bahan yang boleh menyerap kesan dari bola dan boleh menyebabkan kecederaan yang teruk selepas beberapa kali melakukan tandukan. Ia menunjukkan bahawa pemahaman kesan kepala dengan bandana ini yang dipakai oleh pemain dalam permainan adalah pasti kepada pengetahuan biomekanik ini. Objektif kajian ini adalah untuk mengenal pasti bahan yang paling sesuai dan membuat semula bandana berdasarkan keputusan eksperimen yang telah dijalankan. Kajian ini terlibat dengan 2 jenis eksperimen, percubaan pertama yang dijalankan ke atas plat kuasa untuk mencari bahan yang paling sesuai untuk bandana antara 3 jenis bahan ujian. Percubaan kedua yang dijalankan ke atas prototaip tengkorak untuk membandingkan parameter antara keputusan terbaik dari bahan eksperimen sebelumnya dan keadaan tanpa menggunakan apa-apa bahan ujian. Hasil keputusan yang dijangka dari eksperimen adalah nilai bahan harus agak sama atau lebih tinggi atau lebih rendah daripada nilai penanda aras mengikut setiap parameter. Satu bahan yang memenuhi setiap parameter eksperimen telah terbukti sebagai bahan yang terbaik untuk dijadikan bandana dan dipakai oleh pemain Takraw.

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LIST OF SYMBOLS

g	Gravitational Force
m	Mass
m/s	Meter per second
a	Acceleration
F	Force
N	Newton
V	Velocity
t	Time
Px	Pixel
Fr/s	Frame per second
e	Coefficient of restitution

LIST OF ABBREVIATIONS

ISTAF	International Sepak Takraw Federation
HIP	Head Impact Power
FYP	Final Year Project
CCD	Charge-Coupled Device
IEPE	Integrated Electronic Piezoelectric
DAQ	Data Acquisition System
ASTM	American Society for Testing and Materials

CHAPTER 1

INTRODUCTION

1.1 Introduction

One of the activities that can give many benefits to human especially in generating health to our body are sports. Involving ourselves in sports can protect us from many diseases that can threaten our lives, apart from dieting. In Greece back on 776BC where the first Ancient Olympic games were held, history has proved that sporting activities has long been a part of human lifestyle (Swaddling, 2000). Until now, sports have become a global culture where it is being used as a symbol to unite the people around the world. Nowadays, the presence of sports is undoubted as an important medium for the world's development as it can generate a strong relation between countries, organizations and human.

Through this relation, an array of sports event is being held to promote peace and strengthen the relationship among human. This action produced many international sports icon and globally renowned athletes from different kind of sports. Apart from hard work, the emerged of these athletes are being helped by the involvement of technology in sports through the invention and creation of training attire as well as training equipment. Technology has long been part of sports development. The use of training attire can give a big impact not only to the performance of the athletes, but the sports itself.

Because of this situation, the demand of safety in developing training attire has increased. Sports organizations demand the use of the safety training attire of the training. The increase in demand is caused by many factors such as to improve the player's performance. Before the invention of safety training attire, the player's performance is not maintained as during the play, players might get an injury and their performance might not as well as before the injury happened. This situation not only affect the performance of players, but also can affect the performance of the whole team.

Therefore, the used of safety training attire would be great solutions to improve the player's performance. The protection of safety training attire is also one of the main factors that it is good demand. Safety is very important in every sporting activities and through the application of safety protection material, surely it will help a lot. These factors not only contributed to the player's performance, but make the training attire very efficient and reliable during training.

Nowadays, there are many types of safety training attire available in the market for almost kind of sports and one of the attire is the headband. The headband is being used by players for sports activities protection such as in soccer, tennis, basketball and Takraw. The basic concept of the headband is to absorb sweat and keep player's hair from reaching the eyes.

For an example, the NIKE headband that has been produced since 1992 when NIKE assumes the lead in apparel technology with NIKE F.I.T fabrics, build for comfort and protection during high-intensity outdoor workouts. Until now, this headband brand has been widely used for outdoor workout and games because of it revolutionize design.

Nike Dri-FIT is a type of fabric with high-performance, microfiber, polyester fabric wicks sweat away from the body and moves it to the fabric surface, where it evaporates. As a result, Dri-FIT fabric helps you stay dry and comfortable. Other than that, Nike also will ensure that they produce headband features a nice protective device which are usually made of polyester and spandex. Polyester fabrics and spandex are extremely strong. They also very durable which is resistant to most chemicals, stretching and shrinking, wrinkle resistant, mildew and abrasion resistant. These features ensure that headband used not only to absorb sweat and safe, but also it is a need to protect the user's head.

This study was conducted in order to analyze and produce a suitable bandana that can protect a Takraw player in a game from a severe injury that caused by several times of headings. Based on the same situation from early research by Tysvaer and Lochen in Norway (1991), they reported that former professional soccer players head the ball 2,000 times or more in their careers and it was assumed that heading of the ball contributed to a chronic brain injury similar to the injury in boxers. The findings about the material of bandana from this study should be satisfy and comply with the rules and regulation of Takraw games so that players are not prohibited to participate in a game. This is because, according to Sepak Takraw rules and regulation (ISTAF, 2007), any equipment that is designed to increase or reduce the speed of the ball, increase a player's height or movement or in any other way give an unfair advantage and that endangers himself/herself or other players shall not be permitted.

This study involved with 2 types of experiment Takraw ball drop, which the first experiment conducted on the force plate in order to find the most suitable material for bandana among the 3 types of test material which is corrugated cardboard, sponge and composite material that made up of polyurethane, plastic and rubber. For the second experiment conducted on the skull prototype in order to compare the parameters between best material results from the previous experiment and a condition without using any test material. The parameters involve in both experiments was velocity after impact, ball deformation, contact time and coefficient of restitution. Additional parameters that differentiate between the Experiment 1 and 2 are maximum impact force and brain acceleration respectively. The benchmark value for this experiment are produced from the value of Takraw ball drop on a force plate for experiment 1 and drop on the skull prototype for experiment 2.

The expected result produces from the experiment for the value of velocity after impact, coefficient of restitution and ball deformation of material should be relatively closed to the benchmark value, usage of material should increase the contact time from the benchmark value, the value of maximum impact force of material should lower than benchmark value, and the last one is the value of brain acceleration of material also should be lower than benchmark value. All of this will be explain detail in Chapter 4. A material that satisfies each parameter of the experiment was proven as the best material for padded bandana and can be wear by Takraw players as it comply with Sepak Takraw rules and regulations.

1.2 History of Sepak Takraw

'Sepak Takraw' was the name of an ancient game played in the Malay states and in the neighboring countries of Singapore and Brunei. It was created by the royal family of Malaysia about 500 years ago. The name itself comes from two different languages. 'Sepak' is Malay for 'kick' and 'Takraw' is a Thailand word for the rattan ball used in the game, which involved players standing in a circle keeping the ball in the air for as long as possible without using their hands. Variations of this were played in other Southeast Asian countries too where in Philipine it was called 'Sepa Sepa', in Myanmar, 'Ching Loong', in Indonesia, 'Rago' and in Laos, 'Kator'. When it is born, it looked like Japanese 'Kemari', and some became a circle and a pole was kicked, and the number of times was being competed in. It looks very similar to the Japanese traditional game, 'Kemari' where the players form a loose circle and the number of times the ball is kicked before it touches the ground is counted.

In 1965 the game was unified into the present volleyball style with the addition of a net and the adoption of international rules. The International Sepaktakraw Federation (ISTAF) is responsible of all the Sepak Takraw organizations. Modern Sepak Takraw, or Takraw for short (also known as Kick Volleyball), began in Malaysia and is now becoming their national sport. It combines elements of Soccer, Footbag, Volleyball, Baseball, Badminton, Gymnastics and the ancient sport of Sepak Raga. Balls woven of rattan stems have primarily been replaced by woven synthetic balls, which are much safer and more durable. A Sepak Takraw player needs to be extremely good when dealing with the ball. Because even when using a more secure ball, a player can still be prone to injury and concussion if players often do head impact without using any protection. Until now, there is no effective head protection designed for Takraw players to reduce injury and concussion in the match. So, the players might have a problem when it comes to dealing with safety protection.

1.3 Problem Statement

Striking a Takraw ball can be a painful experience especially for the beginner and especially when the forehead or the inner or outer parts of the ankle the most commonly used areas of the body are used because these areas have little or no natural padding in the form of subcutaneous fat or muscle (Tithma & Boonchai, 2004). Normally in Takraw match, players will use a headband on their forehead in order to provide a protection from a continuous impact or a high speed impact of the Takraw ball. But due to the rules and regulation stated that, any equipment that is designed to increase or reduce the speed of the ball, increase a player's height or movement or in any other way give an unfair advantage and that endangers himself/herself or other players shall not be permitted (ISTAF, 2007). Basically only one type of headband that have been used by the player which is called bandana. They often used a bandana on the head just for covering their hair and to sweep sweat (Lizel Tyson, 2012). But a bandana is much more unprotected compared to headband because it does not have a material that can absorb an impact from the ball thus can cause a severe injury.

1.4 Project Objectives

There are two objectives have been defined in this study which is:

(i) To identify the most suitable material of bandana that can protect the head of player.
(ii) To fabricate a bandana which consist of the most suitable material that can be part of the bandana and protect the head of the player.

1.5 Scopes of study

The following scopes of the project are determined in order to achieve the objectives of the project:

(i) The research is only looking at the one type of the headband which is the bandana.
(ii) The research will stress on finding the suitable material to be a part of bandana that used by the Takraw player during the play.
(iii) The material of the bandana headband used is cotton.
(iv) The bandana headband' thickness same as the usual size which is around 2-4 mm.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter will briefly explain about the previous design and concept of headband that have been used in Takraw sport which is a bandana, along with the information of the material used throughout the process.

This valuable information is very important to decide the best application for development of the new Takraw headband, bandana. It is known that there is a Takraw headband has been developed. Therefore, the previous inventions of Takraw headband are being set as a reference to get the best concept for prototyping a Takraw headband.

The previous inventions are also important to decide the materials and mechanism that need to be used in this bandana along with its functions to minimize any weakness in prototyping the Takraw headband. It is also important to determine the design concept that will be applied during designing the bandana.

2.2 Head Impact in Takraw sports

Takraw players most commonly sustain head injuries when a forcefully kicked ball strikes to the head. Using the head to direct the ball, which is called “heading the ball,” is a common feature in a Takraw game. Most commonly, the forehead is used to head the ball although Takraw rules provide that any part of the head may be legally used to strike the ball. The technique of heading the ball is a learned skill that requires practice to master. Unfortunately, learning this skill involves several heads to ball impacts which may occur using improper technique (Victor L. Domingos, 2006).

During practice sessions, players are trained by coaches who use their labor and manual training technique to generate variations of ball motion to train players. Manual training might involve throwing the balls by hand, or hitting the balls with a wooden paddle to athletes for defense and offense drills. For three hours per day of training sessions, players may have to hit the ball repeatedly up to 300 times. Each time a player heads the ball, they in effect, has caused a minor traumatic event to the head. There is a cumulative effect of repeated minor head trauma, which can result in permanent brain damage (Victor L. Domingos, 2006).

A concussion is a trauma-induced change in mental status, with or without unconsciousness caused by an impact to the head or upper body, or by non-contact severe motion, such as whiplash. Its symptoms range from a mild headache, nausea, dizziness, vertigo and heightened sensitivity to light or sound, amnesia to prolonged unconsciousness. It is also believed that a person who has had one concussion is four to six times as likely to have a second concussion as a no concussed player. The second concussion is often significantly more severe than the first, even if the second impact is seemingly minor, because the brain has not completely healed from the first concussion yet. This is often called the second impact syndrome (SIS).

(Newman et al, 1999) conducted a study on the probability of a concussion due to head clashes in American Football. It was observed that head injury severity or probability correlates to the magnitude of the rate of change of kinetic energy that the head undergoes during an impact. Based on this, a HIP equation was derived and its relation to the probability of concusion is established.

2.3 The Sepak Takraw Ball

Even though the size of Takraw ball is much smaller than a soccer ball, but a Takraw player often can get an injury from it. Like balls for football, basketball and others, the Takraw ball is spherical in shape. However, what distinguishes a Takraw ball from other balls are the method by which it is manufactured and the way it looks. A Takraw ball is made by interweaving rattan strips to produce a spherical ball, so it looks like a small spherical basket, which is the literal means of "Takraw" in Thai. A Thai Takraw ball is unique in that it has twenty interweaving crossovers and twelve corresponding apertures (Boonchai Lorhpipat, 1989).

Sepak Takraw balls are very different in size, material, and structure from others balls used in the sports. Sepak Takraw balls that are used to test in this study are the official competition balls (Marathon Model MT 908) which are 0.39 pounds in weight. The balls have a hollow spherical shape 5 inches in diameter with twelve pentagons-shaped holes around the ball surface (see Fig 1.1). The area of each hole is 0.43 square inches. The ball is made from woven synthetic rattan material with a soft rubber outer surface which has good bouncing characteristics and shock absorption (B. Lorhpipat and B. Lorpipatana, 2007)

Based on the site by the Sepak Takraw Association, Takraw balls were originally woven from rattan like in the figure 2.1 but in 1982 a Thai engineer revolutionized the sport by introducing woven synthetic (plastic) balls. Today, almost all players around the world are using synthetic Takraw balls such as in figure 2.2.

Figure 2.1: A woven rattan Sepak Takraw ball

Source: commons.wikimedia.org (2005)

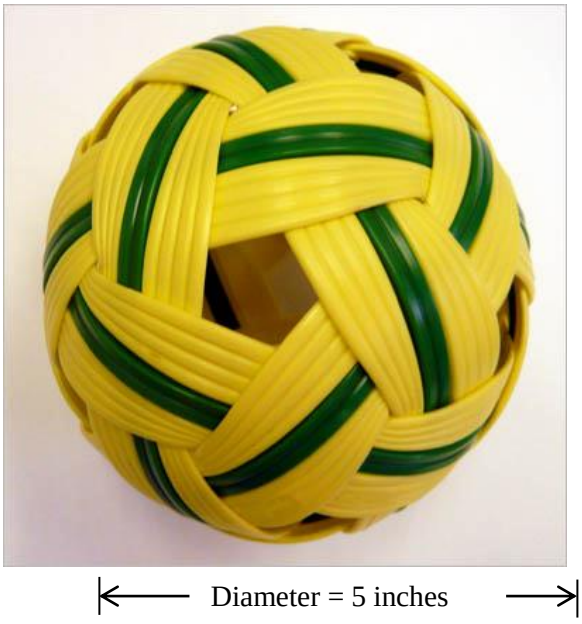

Figure 2.2: Test Ball. Sepak Takraw Ball Officially Approved by International Sepak Takraw Federation (ISTAF) for Men's Events

Source: psingha.com.sg (2007)

Nowadays, there are many types of Takraw ball produced but the most important thing it is produced to reduce the force exerted on the players body but it is comply with the rules of the game as stated in the official international rules governed by the International Sepak Takraw Federation (ISTAF). The example type of Takraw ball that widely used in Canada is shown in Table 2.1.

Table 2.1: Types of Takraw ball produced in Canada

Product	Description
	NP200 – Beginner Takraw Ball • 145 grams • Viking purple with bright yellow center strip • Light weight, soft synthetic (very durable and will not tear break), loose weave • Training Takraw ball for beginner players • Preferred ball for elementary school age or beginner players of any age
	NP300 – Intermediate Training Takraw Ball • 155 grams • Pine green with bright orange center strip • Medium weight, medium hard synthetic, medium weave • Intermediate Player training ball for Elementary and Junior High School. • Preferred ball for free style solo or group circle game sessions
	NP300T – JHS Boys/Girls, HS Girl's and Women's Tournament Takraw Ball • 160 grams. • Slightly heavier weight, for better ball control • Medium tight weave, for a springier bounce • Most used ball, covering widest age range